ENGLISH TRANSLATION OF WO91/32495

SPECIFICATION

LOCOMOTIVE CARRIAGE

Technical Field

This invention relates to a locomotive carriage capable, with ease, of broadwise or lateral movements cross-directionally to its travelling direction.

Background Art

Conventionally, locomotive carriages, such as bulldozers and tanks, are equipped with driving and travelling means on both the right and the left sides relative to their travelling directions which enable free selection of either forward or reverse movements, which in turn enables such carriage to gyrate while remaining in the same position. However, such locomotive carriages as bulldozers and tanks have the following problems which should be solved: The aforementioned locomotive carriages can easily move forward, reverse their directions, and gyrate while remaining in the same position, but broadwise or lateral movements cross-directionally to their travelling directions require an area in excess of twice as great as the size of each such locomotive carriage and the processes of such broadwise movements are greatly cumbersome, requiring gyration, forward movement, reverse gyration and reverse movement.

Disclosure of the Invention

The purpose of the present invention is to provide a locomotive carriage equipped with a plural number of travelling means, such as driving wheels or caterpillars, each of such travelling means constituting a driving and moving means by way of being connected to a driving source, enabling movements on a travelling surface, such locomotive carriage being enabled to easily move broadwise or laterally, cross-directional to its travelling direction.

This invention provides a locomotive carriage capable of moving on its travelling surface by way of a plural number of travelling means, such as driving wheels or caterpillars, having the characteristics that each of such travelling means constitutes a driving and moving means by way of being connected to a driving source, and that such locomotive carriage is so constructed as to be able to swing around any one contact area arbitrarily selected from among a plural number of contact areas between such driving and moving means and the travelling surface.

Brief Descriptions of the Drawings

Fig. 1 shows a top view of the first embodiment example of the locomotive carriage constructed according to the present invention.

Fig. 2 shows a right side view of the locomotive carriage shown in Fig. 1.

Fig. 3 shows a top view of the locomotive carriage illustrated in Fig. 1 and Fig. 2, showing one example of the swinging motion of the locomotive carriage and the center of gravity of the locomotive carriage.

Fig. 4 shows a right side view of the locomotive carriage illustrated in Fig. 1 and Fig. 2, illustrating the state of detachment of the driving wheel 22a from the travelling surface 1 when the piston rod 83 of the fluid pressure cylinder 80 is protracted, where the travelling surface 1 is floor surface and when the center of gravity of the locomotive carriage is within the area G2.

Fig. 5 shows a right side view of the locomotive carriage illustrated in Fig. 1 and Fig. 2, illustrating the state of detachment of the driving wheel 22c from the travelling surface 1 when the piston rod 83 of the fluid pressure cylinder 80 is retracted, where the travelling surface 1 is floor surface and when the center of gravity of the locomotive carriage is within the area G2.

Fig. 6 is a descriptive illustration of the locomotive carriage illustrated in Fig. 1 and Fig. 2, showing one example of the lateral moving processes of the locomotive carriage to the right, where the travelling surface 1 is floor surface and when the center of gravity of the locomotive carriage is within the area G2 shown in Fig. 3 with parallel oblique lines.

Fig. 7 shows a top view of the second embodiment example of the locomotive carriage constructed according to the present invention.

Fig. 8 shows a right side view of the locomotive carriage shown in Fig. 7.

Fig. 9 shows a top view of the third embodiment example of the locomotive carriage constructed according to the present invention.

Fig. 10 shows a right side view of the locomotive carriage shown in Fig. 9.

Fig. 11 is a descriptive illustration of the locomotive carriage illustrated in Fig. 9 and Fig. 10, showing one example of swinging motions of the locomotive carriage.

Fig. 12 is a descriptive illustration of the locomotive carriage illustrated in Fig. 9 and Fig. 10, showing one example of lateral moving processes of the locomotive carriage to the right.

Best Mode for Carrying Out the Invention

One embodiment example of the apparatus constructed in accordance with the present invention is described below by referring to Fig. 1 through Fig. 6.

The locomotive carriage illustrated in Fig. 1 and Fig. 2 is equipped with a frame divided into two sections, one each on the right and on the left of its travelling direction (shown with the arrow F). The left frame 18 is comprised of the main frame 181 with an elongated shape in the travelling direction and made of shape steel, the shaft bearing 182 which is fixed onto one end of the main frame 181 and supports the slave shaft of the driving wheel 22c, the electric motor with a speed reducer 24L which is fixed onto the other end of the main frame 181 and has the driving shaft of the driving wheel 22d and the central connecting frame with the shape of a box 183, where the main frame 181 is welded onto the left side of the central connecting frame 183 and the hinge boss 184 is welded onto the right side thereof for hinge connection with the right frame 16 using the hinge pin 19. Additionally, the bracket 185 is welded onto the top side of the central connecting frame 183 to fix the supporting bracket 84 of the intermediate trunnion mounted fluid pressure cylinder 80.

The right frame 16 is comprised of the main frame 161 with an elongated shape in the travelling direction and made of shape steel, the shaft bearing 162 which is fixed onto one end of the main frame 161 and supports the slave shaft of the driving wheel 22a and the electric motor with a speed reducer 24R which is fixed onto the other end of the main frame 161 and has the driving shaft of the driving wheel 22b, where the hinge boss 163 is welded onto the side of the main frame 161 for hinge connection with the left frame 18 using the hinge pin 19. Additionally, a hole is made on the side of the main frame 161 for the purpose of hinge-connecting the clevis 83 mounted at the tip of the piston rod 82 of the intermediate trunnion mounted fluid pressure cylinder 80. Note that the illustrated driving wheels 22a, 22b, 22c and 22d are solid tires with wear resistant materials, such as polyurethane rubber, fixed onto the peripherals. Additionally, the rotation axis of each of the driving wheels 22c and 22d has a sprocket fixed thereon, and a roller chain 26L is hung between the two sprockets, and the rotation axis of each of the driving wheels 22a and 22b also has a sprocket fixed thereon, and a roller chain 26R is hung between the two sprockets. Thus, the locomotive carriage illustrated in Fig. 1 and Fig. 2 is equipped with one group of driving and moving means having two driving wheels

22c and 22d each constituting a driving and moving means and another group of driving and moving means having two driving wheels 22a and 22b each constituting a driving and moving means, totaling two groups of driving and moving means. Additionally, the cylinder part 81 of the fluid pressure cylinder 80 is mounted onto the supporting bracket 84 with the hinge pin 85, and the relative angle of the left frame 18 and the right frame 16 can be changed to any angle with the hinge pin 19 as the pivot by way of the operation of the fluid pressure cylinder 80. Note that Fig. 4 illustrates the state of detachment of the driving wheel 22a from the travelling surface 1 when the piston rod 83 of the fluid pressure cylinder 80 is protracted and that Fig. 5 illustrates the state of detachment of the driving wheel 22c from the travelling surface 1 when the piston rod 83 of the fluid pressure cylinder 80 is retracted. Note, however, that Fig. 4 and Fig. 5 illustrate the state of the locomotive carriage when the travelling surface 1 is floor surface and the center of gravity of the locomotive carriage is within the area G2 shown with parallel oblique lines in Fig. 3. In Fig. 3, pa is the contact area between the driving wheel 22a and the travelling surface 1, pb is the contact area between the driving wheel 22b and the travelling space 1, pc is the contact area between the driving wheel 22c and the travelling space 1, pd is the contact area between the driving wheel 22d and the travelling space 1, cc is the intersection point of two straight lines, one connecting pa and pd, the other connecting pb and pc, and the area G2 is the area surrounded by three straight lines connecting pb and pd, pb and cc and pd and cc, respectively.

The action and the effect of the apparatus described above are explained below.

In Fig. 1, when the driving wheels 22c and 22d and the driving wheels 22a and 22b are revolved in the same direction by starting the electric motors with speed reducers 24L and 24R of the locomotive carriage, the locomotive carriage will travel straight on the travelling surface 1 (moving forward as shown with the arrow F or reversing its direction as shown with the arrow R), and when the driving wheels 22c and 22d and the driving wheels 22a and 22b are revolved in the opposite direction from each other, the locomotive carriage swings (counter-clockwise or clockwise) around its central axial line, facing the desired direction as a result.

Fig. 3 is an illustration showing one example of the swinging motion of the locomotive carriage of the present invention, and illustrates the locomotive carriage in

the state of detachment of the driving wheel 22a from the travelling surface 1 when the piston rod 83 of the fluid pressure cylinder 80 is protracted. In said Fig. 3, when the electric motor with a speed reducer 24L is revolved so that the group of driving and moving means on the left side may move in the direction of the arrow A while the electric motor with a speed reducer 24R is kept turned off, the central portion of the locomotive carriage swings clockwise in the direction of the arrow C with the contact area pb between the driving wheel 22b and the travelling surface 1 as the pivot. Note that P is the center of the swinging motion of the locomotive carriage and the arrow B is the swinging direction of the driving wheel detached from the travelling surface 1.

Fig. 6 illustrates one example of lateral moving processes of the locomotive carriage to the right where the travelling surface 1 is floor surface and when the center of gravity of the locomotive carriage is within the area G2 shown in Fig. 3 with parallel oblique lines.

In Fig. 6, the coordinates XO and YO are added as indicators for the purpose of understanding the lateral or broadwise movement of the locomotive carriage. Each of the drawings illustrated in a chronological order in Fig. 6 shows the position of the locomotive carriage at each respective time point, showing the position of the locomotive carriage immediately prior to its broadwise movement at each such time point, the arrow A showing the direction in which the driving wheel to be revolved and driven is driven, the arrow C showing the direction in which the central portion of the locomotive carriage moves, the arrow B showing the direction in which the driving wheel detached from the travelling surface 1 moves and P showing the pivot of the swinging motion of the locomotive carriage.

Note that in Fig. 1, if the travelling surface 1 is wall surface and if the locomotive carriage has the function of adhering to the travelling surface 1, the arrow F showing its top side and the arrow R its bottom side, and of simultaneously moving along the travelling surface 1, the adhesive force in action on the locomotive carriage gives the central portion of the locomotive carriage pushing force in the direction of the travelling surface 1 while the locomotive carriage's own weight gives the central portion of the locomotive carriage downward pushing force in the direction of the arrow R, and therefore, the forward (upper) driving wheels 22a and 22c are in the state more inclined to be detached from the travelling surface 1 compared to the aft (lower) driving wheels 22b and

22d. For this reason, the conditions of the movement processes of the locomotive carriage when it is on wall surface and moves laterally or broadwise can be deemed to be similar to those when the travelling surface 1 is floor surface and when the locomotive carriage with its center of gravity located in the area G2 makes lateral or broadwise movements. In Fig. 6, therefore, the travelling surface 1 can also be considered to be wall surface.

The chronological moving processes of the lateral or broadwise movement to the right of the locomotive carriage shown in Fig. 6 are explained below.

In Fig. 6-(1), when the driving wheel 22c and the driving wheel 22d are revolved and driven so that they move in the direction of the arrow A, the locomotive carriage swings clockwise with the contact area P between the driving wheel 22b which is not revolved or driven and the travelling surface 1 as the pivot, and stops at the position shown in Fig. 6-(2).

In Fig. 6-(2), when the driving wheel 22c and the driving wheel 22d are revolved and driven so that they move in the direction of the arrow A, and simultaneously when the driving wheel 22a and the driving wheel 22b are revolved and driven so that they move in the direction of the arrow A, the locomotive carriage swings counter-clockwise with P situated at the central portion of the locomotive as the pivot, and stops at the position shown in Fig. 6-(3).

In Fig. 6-(3), when the driving wheel 22a and the driving wheel 22b are revolved and driven so that they move in the direction of the arrow A, the locomotive carriage swings clockwise with the contact area P between the driving wheel 22d which is not revolved or driven and the travelling surface 1 as the pivot, and stops at the position shown in Fig. 6-(4). Note that Fig. 6-(4) shows the position of the locomotive carriage when the lateral or broadwise movement of the locomotive carriage is completed.

Illustrated above was one example of the moving processes to the right of the locomotive carriage illustrated in Fig. 1 and Fig. 2. No description of the moving processes to the left is given here as it is easily understood based on the above descriptions.

The second embodiment example of the apparatus constructed in accordance with the present invention is described below by referring to Fig. 7 and Fig. 7. Unlike the locomotive carriage illustrated in Fig. 1 and Fig. 2, the locomotive carriage illustrated in Fig. 7 and Fig. 8 is not equipped with the fluid pressure cylinder 80 to freely

change the relative angle of the left frame 18 and the right frame 16 with the hinge pin 19 as the pivot. For this reason, the driving wheels of the locomotive carriage illustrated in Fig. 7 and Fig. 8 is undetachable from the travelling surface 1. Further, said locomotive carriage is equipped with an independent electric motor with a speed reducer 24RR for the driving wheel 22a instead of the driving wheel 22a being driven by the electric motor with a speed reducer 24R through the roller chain 26R. Additionally, instead of the driving wheel 22c being driven by the electric motor with a speed reducer 24L through the roller chain 26L, said locomotive carriage is equipped with an independent electric motor with a speed reducer 24LL for the driving wheel 22c. Note that, except for the above-described construction differences, the locomotive carriage illustrated in Fig. 7 and Fig. 8 has the identical construction as the locomotive carriage illustrated in Fig. 1 and Fig. 2.

The action and the effect of the above-described apparatus are explained below.

In Fig. 7, when the driving wheels 22c and 22d and the driving wheels 22a and 22b are revolved in the same direction by starting the electric motors with speed reducers 24LL and 24L, and 24RR and 24R, respectively, of the locomotive carriage, the locomotive carriage will travel straight on the travelling surface 1 (moving forward as shown with the arrow F or reversing its direction as shown with the arrow R), and when the driving wheels 22c and 22d and the driving wheels 22a and 22b are revolved in the opposite direction from each other, the locomotive carriage will swing (counter-clockwise or clockwise) around its central axial line, facing the desired direction as a result.

In Fig. 7, when the driving wheel 22a is driven in the direction in which it attempts to move in the direction of the driving wheel 22b while the driving wheel 22b is kept stationary, the driving wheel 22a will simply slip and stay at its position. That is, because dynamic frictional resistance is less than stationary frictional resistance, the frictional force between the driving wheel 22a and the wall surface 1 is reduced by way of the action of such slipping. When this happens and if the driving wheel 22c and the driving 22d are revolved and driven so that the left group of driving and moving means move in the direction of the arrow A, the central portion of the locomotive carriage will swing clockwise in the direction of the arrow C with the contact area pb between the driving wheel 22b and the travelling surface 1 as the pivot because the frictional force of the driving wheel 22a is reduced as to the wall surface 1 at this time. Note that P is the center of the swinging motion of the locomotive carriage and the arrow B shows the

swinging direction of the driving wheel detached from the travelling surface 1. As is easily understandable, the locomotive carriage equipped with vibrating means as described above is capable of moving broadwise, similarly to those of the locomotive carriage illustrated in Fig. 1 and Fig. 2.

Described above is the second embodiment example of the apparatus constructed according to the present invention. The present invention is not limited to such embodiment example, however, and various shape changes and modifications may be made without departing from the scope of the present invention: Essential to the locomotive carriage illustrated in Fig. 7 and Fig. 8 is the fact that it is so constructed that, except for any one contact area arbitrarily selected from among a plural number of contact areas between the driving and moving means and its travelling surface arbitrarily selected either on its left or the right side relative to its travelling direction, the frictional resistance of the remaining contact area is reduced. For example, other means of reducing the frictional resistance of such contact areas include the mounting of a vibrating means, such as a publicly known pneumatic piston vibrator (not illustrated), near the driving wheel 22a of the locomotive carriage illustrated in Fig. 7, thereby reducing the frictional resistance between the driving wheel 22a and the travelling surface 1 by way of the action of such vibrating means.

Proposed above are several means of reducing the frictional resistance of the contact areas between driving and moving means and the travelling surface, except for any one contact area arbitrarily selected from among a plural number of contact areas arbitrarily selected either on the left or the right side of the locomotive carriage relative to the direction of its travelling direction. An additional means of reducing such frictional resistance, which is not illustrated herein, is the construction of a locomotive carriage in such a way that the contact pressure between one arbitrarily selected contact area, which is the center of the swinging motion of the locomotive carriage, and its travelling surface is greater than the contact pressure between the other contact areas and the travelling surface, resulting in lower frictional resistance of such other contact areas than that of such one arbitrarily selected contact area. For example, selecting such one contact area closer to the center of gravity of the locomotive carriage with such other contact areas placed farther away from the center of gravity will increase the contact pressure between such one arbitrarily selected contact area and the travelling surface.

In the first and the second embodiment examples of the present invention described above, the locomotive carriage is equipped with a group of driving and moving means comprised of two sets of driving and moving means, i.e., two sets of driving wheels, one on each side of the left and the right side of the locomotive carriage relative to its travelling direction. Alternatively, the locomotive carriage may be equipped with one set or three or more sets of driving wheels instead of two sets of driving wheels or with universally known endless tracks or caterpillars for each such group of driving and moving means. In case of the group of driving and moving means in the aforementioned embodiment examples, the locomotive carriage has two sets of driving wheels arranged along the same straight lines parallel to its travelling direction, but if such group of driving and moving means are comprised of a plural number of driving and moving means, each such driving and moving means may not necessarily be arranged along the same straight line parallel to the travelling direction of the locomotive carriage, but may be shifted away from the axial line of the travelling direction.

The third embodiment example of the apparatus constructed in accordance with the present invention is described below by referring to Fig. 9 through Fig. 12.
The locomotive carriage illustrated in Fig. 9 and Fig. 10 is comprised of the frame 19, the electric motor with a speed reducer 24R having a driving shaft for the driving wheel 22b, the electric motor with a speed reducer 24L having a driving shaft for the driving wheel 22d and the electric motor with a speed reducer 24E having a driving shaft for the driving wheel 22e, where the frame 19 is comprised of the box-shaped central frame 194, the left frame 192 welded onto the left side of the central frame 194 and the right frame 191 welded onto the right side of the central frame 194. The electric motor with a speed reducer 24L is fixed onto the rear end of the left frame 192, the electric motor with a speed reducer 24R is fixed onto the rear end of the right frame 191 and the electric motor with a speed reducer 24E is fixed onto the forward side of the central frame 194. The left frame 192 and the right frame 191 are made of shape steel. Note that the arrow F indicates the forward movement, and the arrow R indicates the reverse movement, of the locomotive carriage. Note also that the illustrated driving wheels 22b, 22d and 22e are solid tires with wear resistant materials, such as polyurethane rubber, fixed onto the peripherals. Thus, the locomotive carriage illustrated in Fig. 9 and Fig. 10 is equipped with three driving wheels, each of which constituting a driving and moving means.

The action and the effect of the above-described apparatus are explained below. In Fig. 9, when the driving wheels 22d, 22b and 22e are revolved in the same direction by starting the electric motors with speed reducers 24L, 24R and 24E of the locomotive carriage, the locomotive carriage will travel straight on the travelling surface 1 (moving forward as shown with the arrow F or reversing its direction as shown with the arrow R). When the driving wheels 22d and 22b are revolved in the opposite direction from each other while the driving wheel 22e is kept from revolving, the locomotive carriage will swing (counter-clockwise or clockwise).

Fig. 11 is a descriptive illustration of the locomotive carriage illustrated in Fig. 9 and Fig. 10, showing another example of its swinging motion other than described above. In said Fig. 11, when the electric motors with speed reducers 24L and 24 E are revolved so that the driving wheels 22d and 22e may move in the direction of the arrow A while the electric motor with a speed reducer 24R is kept turned off, the central portion of the locomotive carriage will swing clockwise in the direction of the arrow C with the contact area pb between the driving wheel 22b and the travelling surface 1 as the pivot. Note that P is the center of the swinging motion of the locomotive carriage and that the chain lines td and te indicate the tracks of the movements of the driving wheels 22d and 22e, respectively.

The processes of the lateral or broadwise movement of the aforementioned locomotive carriage are described below.

Fig. 12 illustrates one example of the lateral movement to the right of the locomotive carriage.

Note that, in Fig. 12, the coordinates XO and YO are added as indicators for the purpose of understanding the lateral or broadwise movement of the locomotive carriage. Each of the drawings illustrated in a chronological order in Fig. 12 shows the position of the locomotive carriage at each respective time point, showing the position of the locomotive carriage immediately prior to its broadwise movement at each such time point, the arrow A showing the direction in which the driving wheel to be revolved and driven is driven, the arrow C showing the direction in which the central portion of the locomotive carriage moves, the arrow B showing the direction in which the driving wheel detached from the travelling surface 1 moves and P showing the pivot of the swinging motion of the locomotive carriage.

Note that, in Fig. 9 and Fig. 10, if the travelling surface is wall surface and if the locomotive carriage has the function of moving along the travelling surface 1 while adhering to the travelling surface 1 with the arrow F indicating the top side and the arrow R indicating the bottom side of the locomotive carriage, the conditions of the lateral or broadwise movement of the locomotive carriage may be deemed to be almost the same between floor surface and wall surface as the travelling surface. In Fig. 12, therefore, the travelling surface 1 may be considered to be wall surface. In Fig. 9 and Fig. 10, if the travelling surface 1 is wall surface and if the locomotive carriage has the function of moving along the travelling surface 1 while adhering to the travelling surface 1 with the arrow F indicating the top side and the arrow R indicating the bottom side of the locomotive carriage, however, the two sets of driving wheels should preferably be placed at the bottom side of the locomotive carriage. The reason is as follows: The adhesive force which acts on the locomotive carriage gives the central portion of the locomotive carriage pressing force in the direction of the travelling surface 1 while the locomotive carriage's own weight gives the central portion of the locomotive carriage downward force in the direction of the arrow R, and as a result, the forward (top side) driving wheel is in the state more inclined to be detached from the travelling surface 1 compared to the aft (bottom side) driving wheels, and therefore, placing said two sets of driving wheels toward the bottom side of the locomotive carriage will increase the stability of its movements.

The lateral or broadwise movement processes to the right of the locomotive carriage shown in Fig. 12 are chronologically explained below.

In Fig. 12-(1), when the driving wheel 22e and the driving wheel 22d are revolved and driven so that they move in the directions of the arrows Ae and Ad, respectively, the locomotive carriage will swing clockwise with the contact area P between the driving wheel 22b which is not revolved and driven and the travelling surface 1 as the pivot, and stops at the position shown in Fig. 12-(2).

In Fig. 12-(2), when the driving wheel 22d and the driving wheel 22b are revolved and driven so that they move in the direction of the arrows Ad and Ab, respectively, while the driving wheel 22e is kept from revolving, the locomotive carriage will swing counterclockwise with the contact area P between the driving wheel 22e which is not revolved and driven and the travelling surface 1 as the pivot, and stops at the position shown in Fig. 12-(3).

In Fig. 12-(3), when the driving wheel 22e and the driving wheel 22b are revolved and driven so that they move in the direction of the arrows Ae and Ab, respectively, the locomotive carriage will swing clockwise with the contact area P between the driving wheel 22d which is not revolved and driven and the travelling surface 1, and stops at the position shown in Fig. 12-(4). Note that Fig. 12-(4) shows the position of the locomotive carriage when its lateral or broadwise movement is completed.

Illustrated above was one example of the movement processes of the lateral movement to the right of the locomotive carriage illustrated in Fig. 9 and Fig. 10. The movement processes of the lateral movement to the left are not described here because they are easily understood from the above descriptions of the lateral movement to the right.

Described above was the third embodiment example of the apparatus constructed in accordance with the present invention.

Described above were the first through the third embodiment examples of the apparatus constructed in accordance with the present invention. Such locomotive carriage as described above may be effectively utilized as a locomotive carriage which performs various types of work along its travelling surface, such as floor surface, and which is capable, with ease, of broadwise or lateral movements cross-directionally to its travelling direction. Further, the present invention may be applied to a locomotive carriage which has the function of vacuum-adhering to, and moving along, its travelling surface, such as wall surface, as disclosed in the Patent No. 1323843. For example, the locomotive carriage concerned herein may be effectively used as a locomotive carriage which performs exfoliation of old film from, or painting on, the surface of large structures, such as the hull of a ship, various tanks or buildings, or underwater cleaning of ships' bottoms, and is capable, with ease, of moving laterally or broadwise cross-directionally to its travelling direction.

Described in detail above was the best mode of the embodiment examples of the apparatus constructed in accordance with the present invention. The present invention is not limited to such embodiment example, however, and, needless to say, various shape changes or modifications may be made without departing from the scope of the present invention.

Further, applications of the present invention are not limited to such embodiment examples, but may be applied to locomotive carriages which travel along

various types of floor space and those which travel along wall surface while adhering to such wall surface.

Because the locomotive carriage under the present invention is capable of moving laterally or broadwise, cross-directionally to its travelling direction, it has the advantage of requiring minimum space for such broadwise movement, and has the advantage of requiring minimum time for such broadwise movement.

CLAIMS

1. A locomotive carriage capable of moving on its travelling surface by way of a plural number of travelling means, such as driving wheels or caterpillars, having the characteristics that each of such travelling means constitutes a driving and moving means by way of being connected to a driving source, and that such locomotive carriage is so constructed as to be able to swing around any one contact area arbitrarily selected from among a plural number of contact areas between such driving and moving means and the travelling surface.

2. The locomotive carriage of claim 1 above, equipped with driving and moving means comprised of at least two sets of driving wheels or one set of caterpillar on each of its right and the left sides relative to its travelling direction.

3. The locomotive carriage of claim 2 above, having the characteristic of being so constructed that, except for any one contact area arbitrarily selected from among a plural number of contact areas arbitrarily selected either on the right or the left side relative to its travelling direction, the remaining contact area between the driving and moving means and its travelling surface be prevented from contacting each other.

4. The locomotive carriage of claim 2 above, having the characteristic of being so constructed that, except for any one contact area arbitrarily selected from among a plural number of contact areas arbitrarily selected either on the right or the left side relative to its travelling direction, the remaining contact area between the driving and moving means and its travelling surface be reduced as to their frictional resistance.

5. The locomotive carriage of claim 4 above, having the characteristic of being equipped with a vibrating apparatus, such as a piston vibrator, in order to reduce the frictional resistance at the remaining contact area.

6. The locomotive carriage of claim 4 above, having the characteristic of being so constructed that the driving and moving means whose frictional resistance is to be reduced be slipped so that the frictional resistance of the remaining contact area be reduced.

7. The locomotive carriage of claim 4 above, having the characteristic of being so constructed that the contact pressure at any one arbitrarily selected contact area with its travelling surface be greater than the contact pressure at the remaining contact area with its travelling surface so that the frictional resistance at the remaining contact area be reduced.

8. The locomotive carriage of any one of claims 3 to 7 above, being equipped, with respect to the moving processes enabling such locomotive carriage to move laterally or broadwise cross-directionally to its primary travelling direction, with the moving processes in which the revolution of the driving and moving means located at any one arbitrarily selected contact area be stopped and, at the same time, the driving and moving means placed on the other side be revolved.

9. The locomotive carriage of claim 1 above, being equipped with one driving wheel on each of its right and left sides relative to its travelling direction, and is equipped with one driving wheel either on its front or rear side relative to its travelling direction.

10. The locomotive carriage of claim 9 above, being equipped, with respect to the moving processes enabling such locomotive carriage to move laterally or broadwise cross-directionally to its primary travelling direction, with the processes in which the revolution of the driving wheel located either on the right or the left side of such locomotive carriage relative to its travelling direction be stopped and at the same time, the driving wheel located on the opposite side and the driving wheel located either on the front or back side be revolved.

11. The locomotive carriage of claim 9 above, being equipped, with respect to the moving processes enabling such locomotive carriage to move laterally or broadwise cross-directionally to its primary travelling direction, with the processes in which the revolution of the driving wheel located on the front or the back side of such locomotive carriage relative to its travelling direction, be stopped and at the same time, the two sets of driving wheels located on the right and the left sides of such locomotive carriage relative to its travelling direction be revolved in the opposite directions from each other.

ABSTRACT

The present invention provides a locomotive carriage capable, with ease, of moving laterally or broadwise, cross-directionally to its travelling direction.

The present invention concerns a locomotive carriage capable of moving on its travelling surface by way of being equipped with a plural number of travelling means, such as driving wheels or caterpillars, each such travelling means constituting driving and moving means driven by way of being connected to a driving source, such locomotive carriage being so constructed as to swing around any one arbitrarily selected contact area from among a plural number of contact areas between such driving and moving means and its travelling direction.

Fig.1

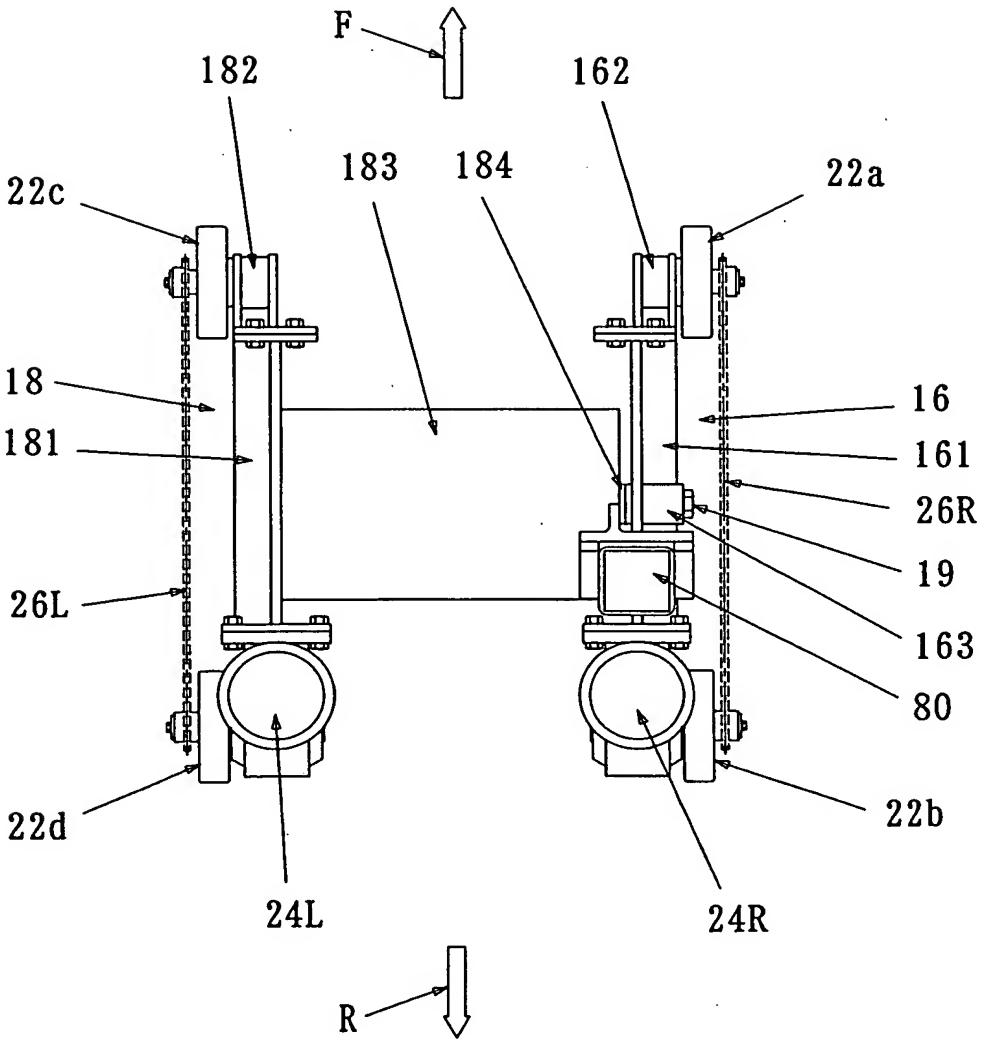
F
182
162
183
184
22a
22c
18
16
181
161
26R
19
26L
163
80
22d
22b
24L
24R
R

Fig.2

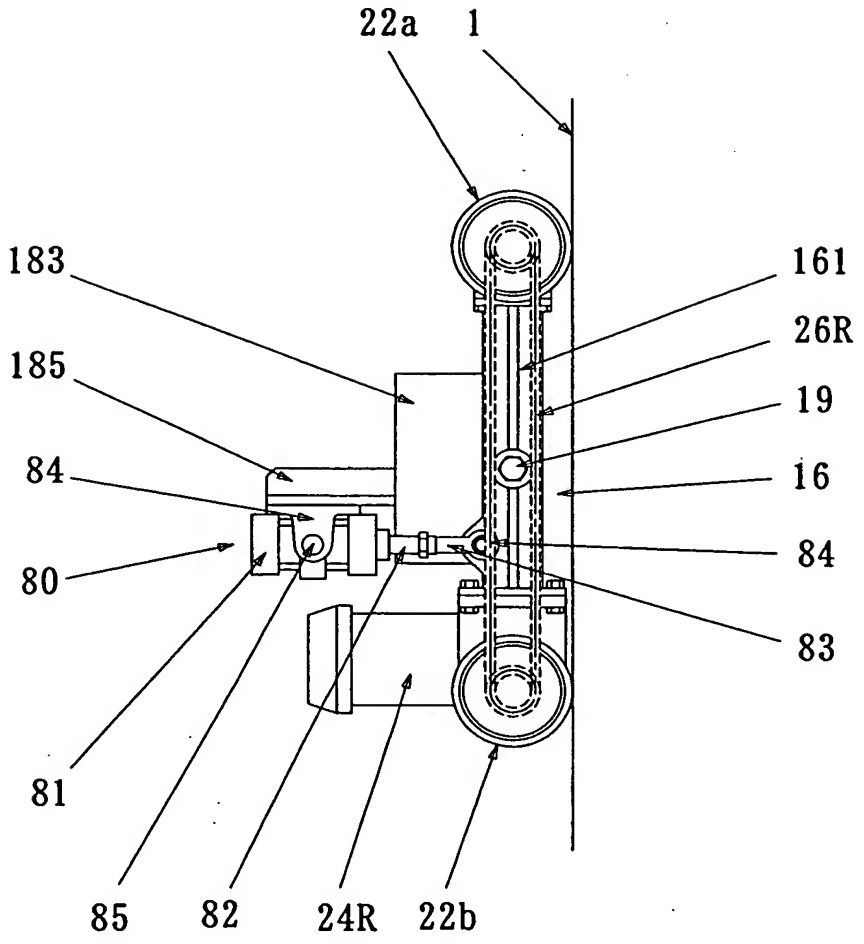

Fig.3

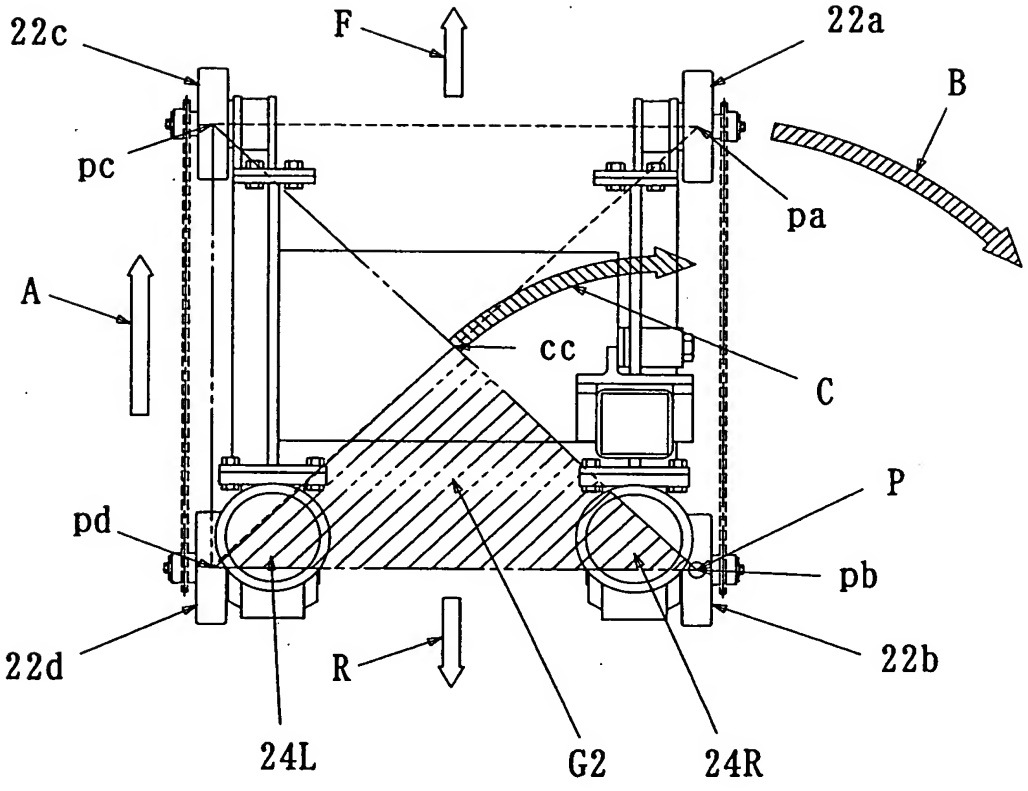

Fig.4

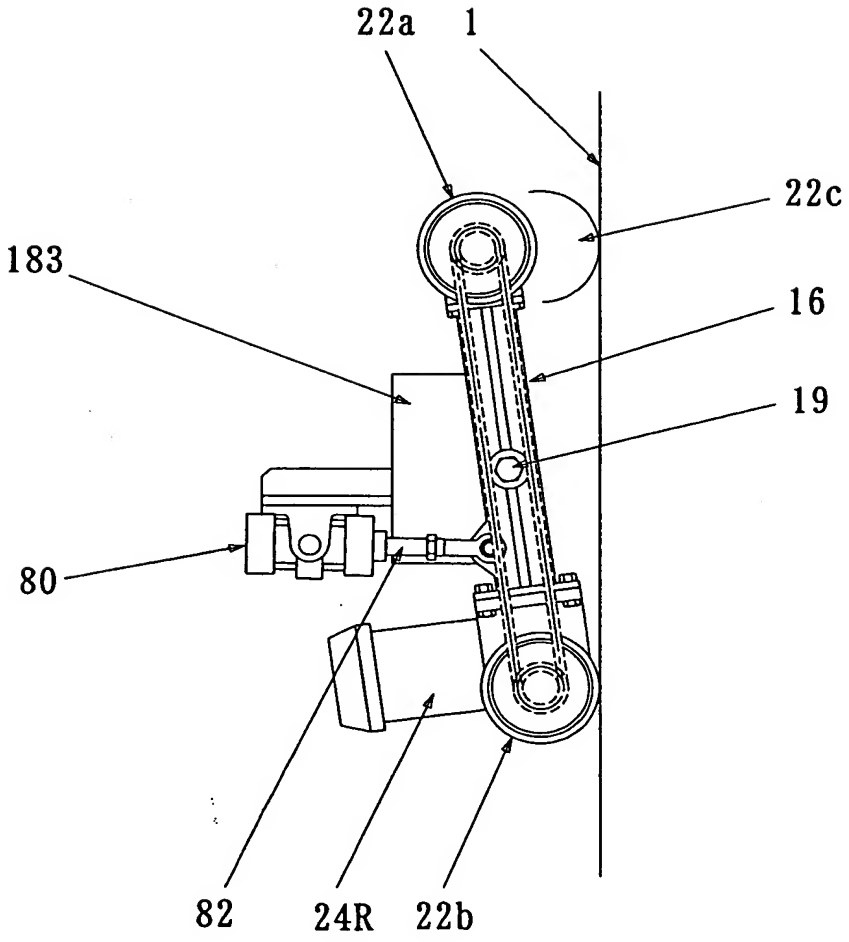

Fig.5

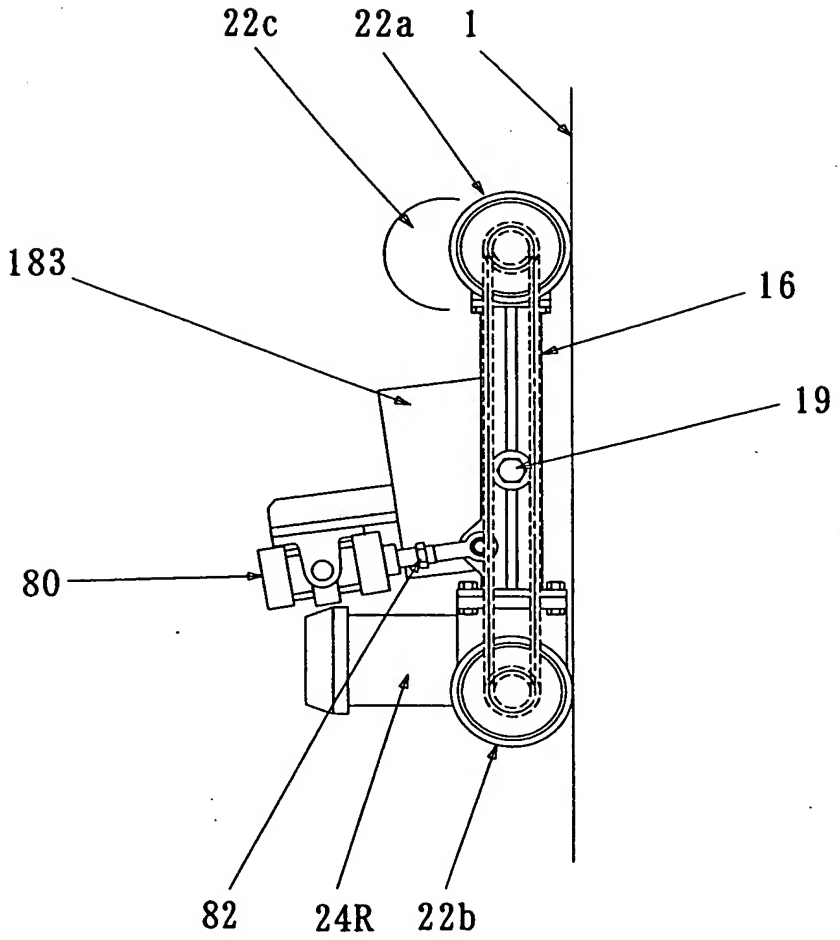

Fig.6

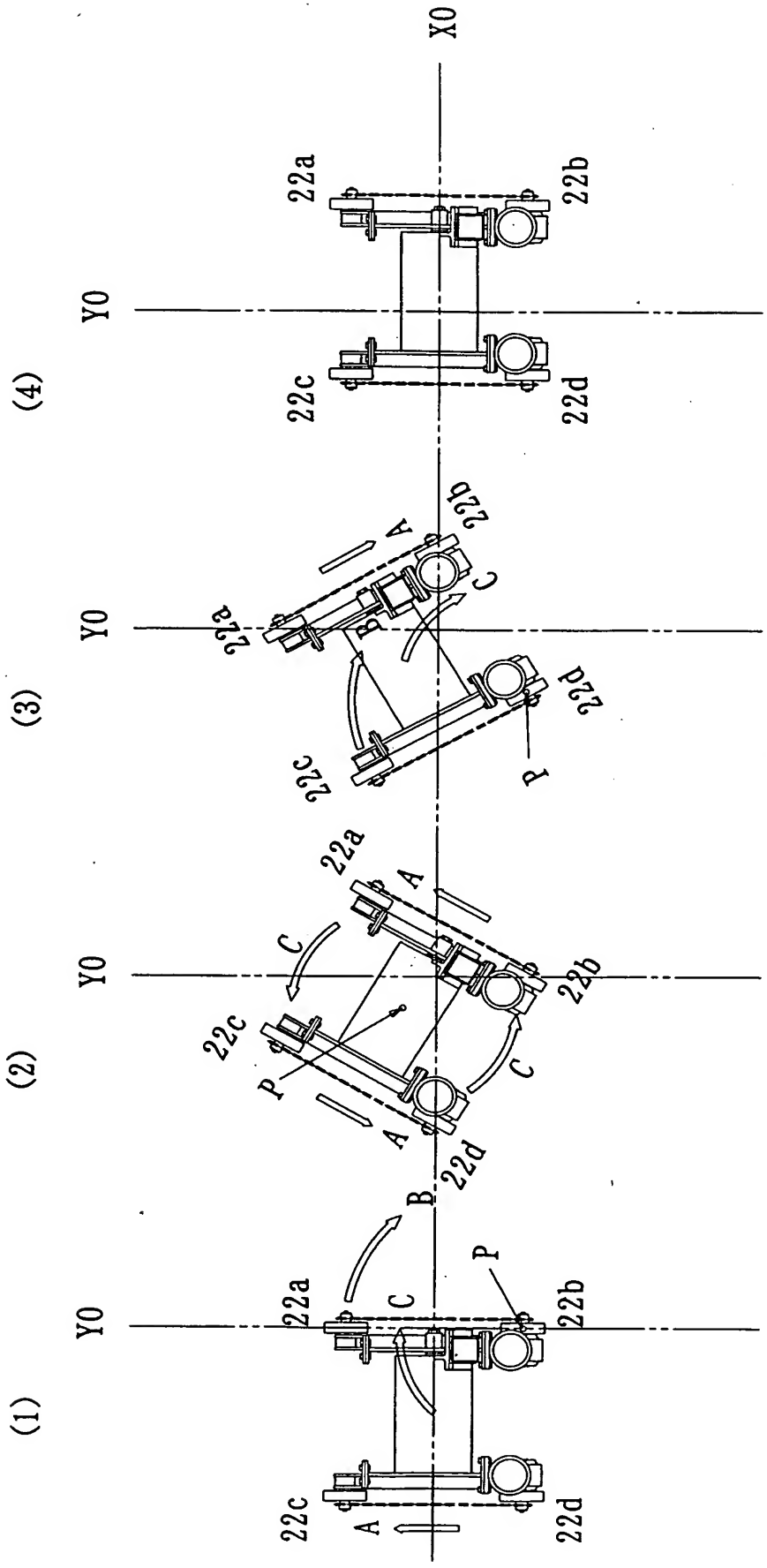

Fig.7

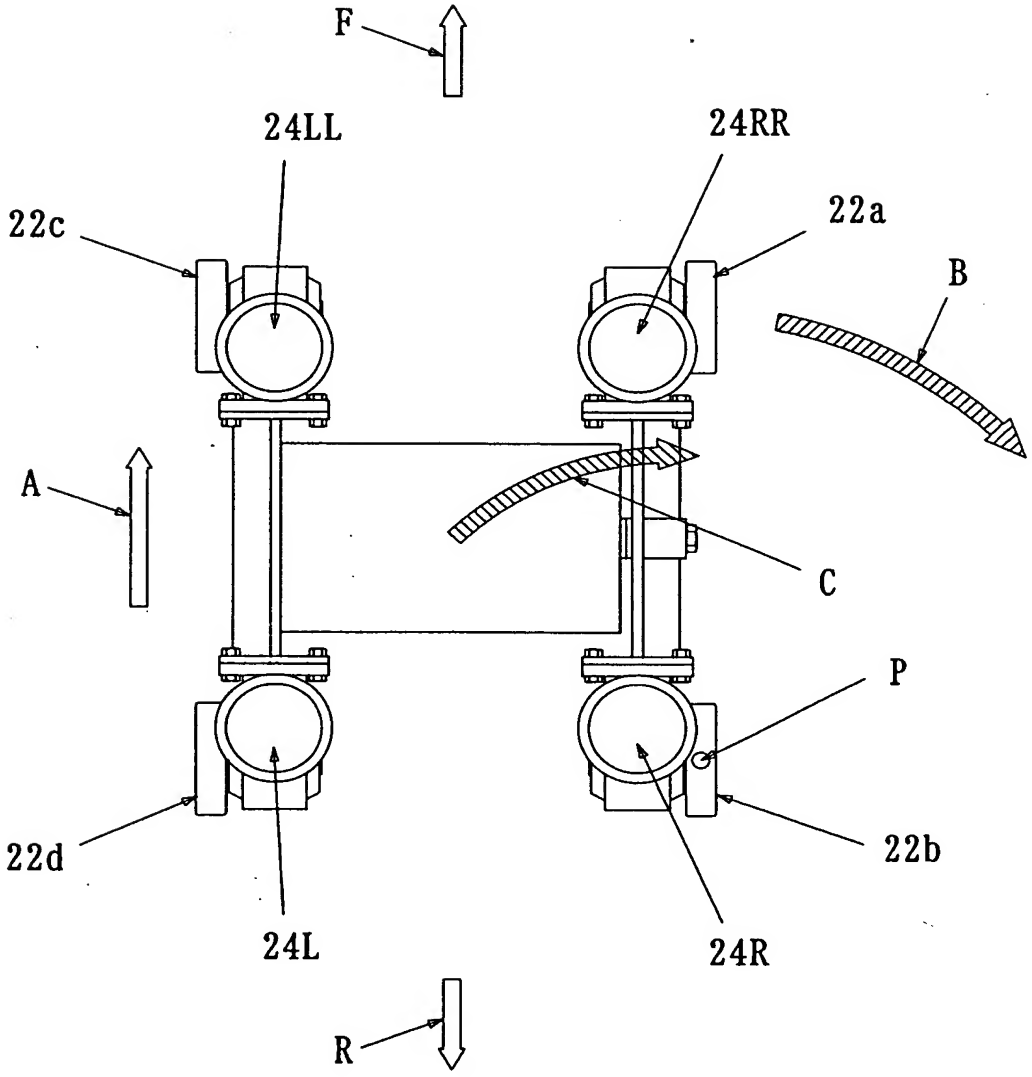

Fig.8

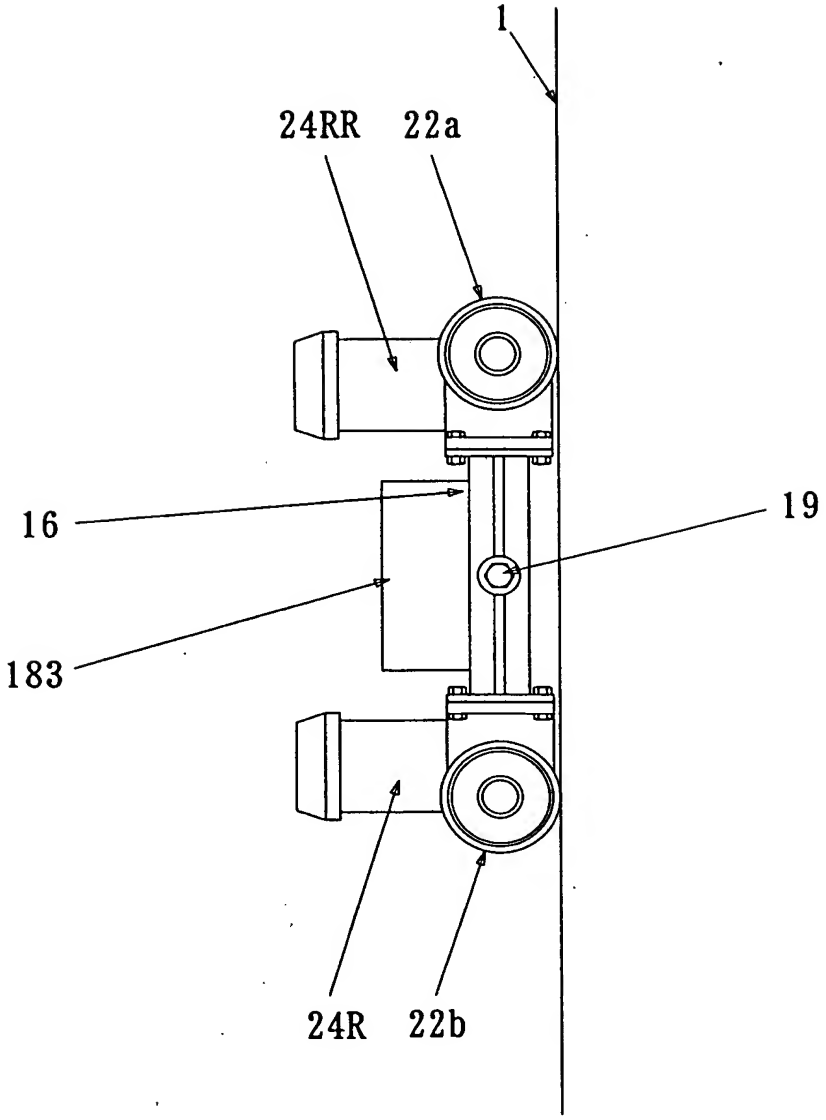

Fig.9

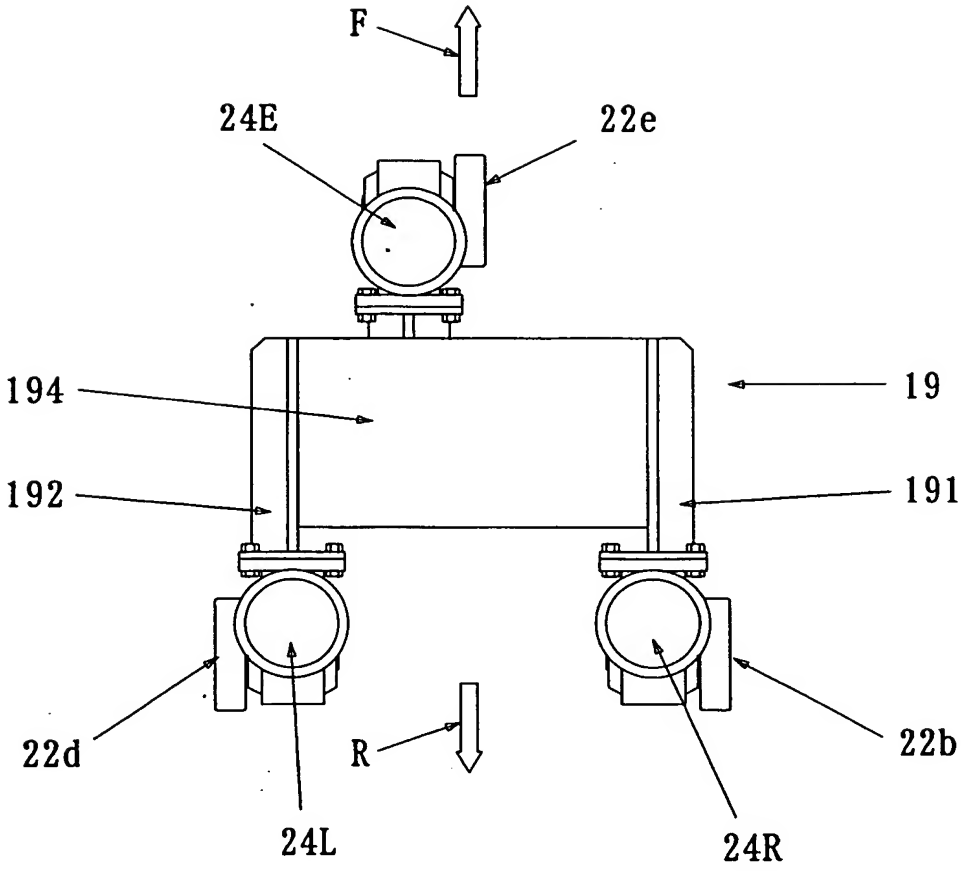

Fig.10

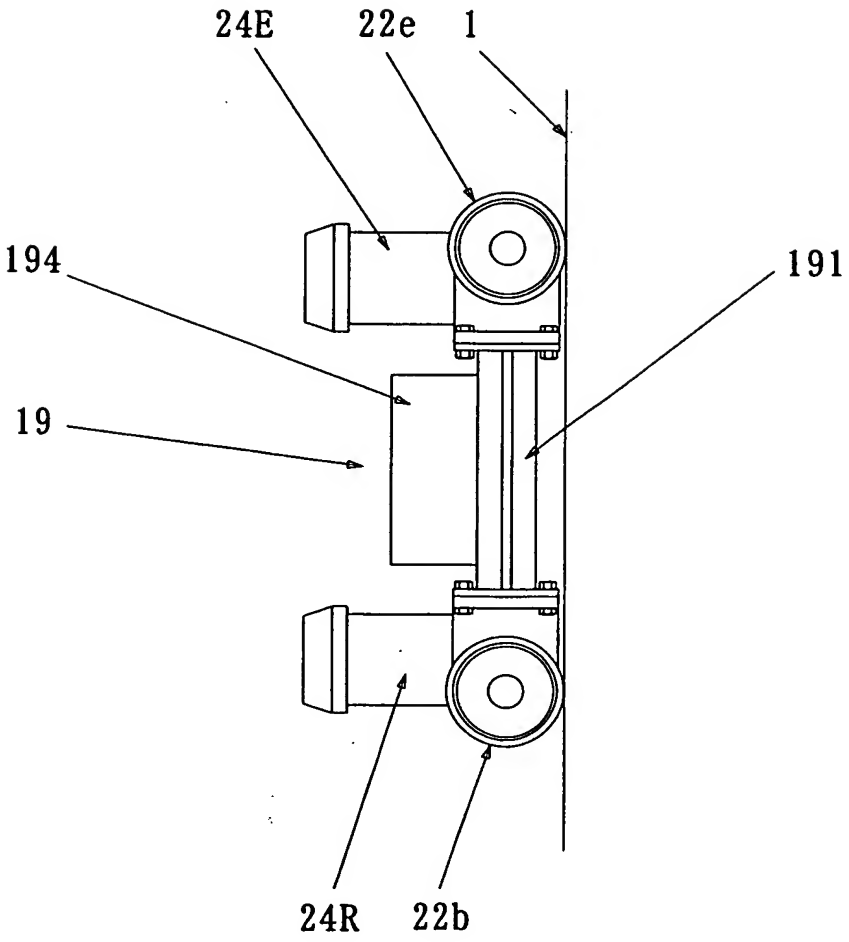

Fig.11

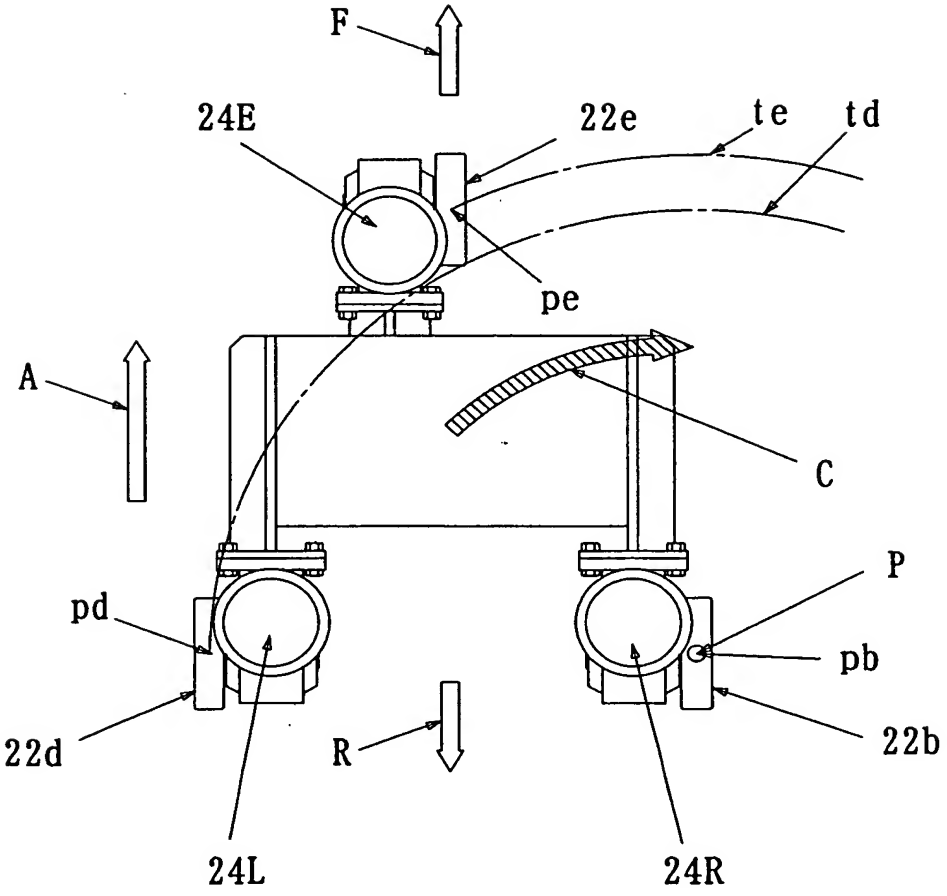

Fig.12